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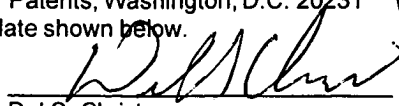
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Del S. Christensen

<sup>23</sup>  
Date: April 17, 2000



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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of )

WILHELMUS H. P. M. HEIJNEN )

Serial No. 09/724,079 )

Group Art Unit: NA

Filed November 28, 2000 )

Examiner: NA

PIPE CONNECTING METHOD )

<sup>23</sup>  
Date: April 17, 2001

ASSISTANT COMMISSIONER FOR PATENTS  
Washington, DC 20231

Sir:

**CLAIM TO PRIORITY**

Applicant(s) reaffirm the claim for the benefit of filing date of the following foreign patent application referred to in Applicant's Declaration:

European Application Serial No. 99309531.4 filed November 29, 1999.

A copy of the application certified by the European Patent Office is enclosed.

Respectfully submitted,

WILHELMUS H. P. M. HEIJNEN

By



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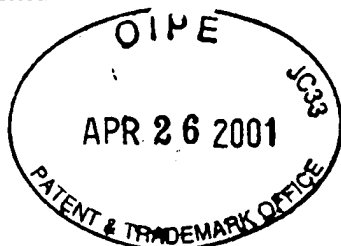
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Patentanmeldung Nr. Patent application No. Demande de brevet n°

99309531.4

Der Präsident des Europäischen Patentamts;  
Im Auftrag

For the President of the European Patent Office

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I.L.C. HATTEN-HECKMAN

DEN HAAG, DEN  
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Blatt 2 der B scheinigung  
Sheet 2 of the c rtificate  
Page 2 de l'attestation

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Pipe connecting device

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## PIPE CONNECTING DEVICE

The present invention relates to a pipe connecting device. Such a device is used to connect the first end of a second pipe to the second end of a first pipe. These pipes can be sections of a pipeline or well tubulars that are used in a well for producing hydrocarbons from an underground reservoir.

In particular such a device is used in connection with interconnecting casing strings or liners. The casing string is a string of steel pipe sections that is used to line a borehole extending through an underground formation, and that is secured to the formation by means of cement. In a single well there may be two or more casing strings, wherein the upper end of the next casing string is hung off from the lower end of the preceding casing string. In order to be able to bring the next casing string into place, the outer diameter of the next casing string has to be smaller than the inner diameter of the preceding casing string. The next casing string may also be a so-called liner. In the specification the expression 'casing string' will also be used to refer to a liner.

Nowadays there are techniques that allow enlarging the diameter of a casing string when it is in the borehole. However, these techniques do not allow expanding the connection where the next casing string is hung off from the previous casing string.

Thus there is a need to provide a device that enables connecting the first end of the second pipe to the second end of the first pipe such that the inner diameter at the

- 2 -

connection is not less than the inner diameter of the first pipe.

5 To this end the device according to the present invention for connecting the first end of a second pipe to the second end of a first pipe, wherein the second end of the first pipe is provided with an anvil section, comprises a cylindrical body provided with an annular shoulder for positioning the device at the first end of the second pipe and an annular recess, an explosive  
10 charge that is arranged in the annular recess and a device for detonating the explosive charge.

The invention will now be described by way of example in more detail with reference to the accompanying drawing showing schematically a partial longitudinal section of  
15 the device 10 according to the present invention in a position in which it can connect the first end of a second pipe in the form of the top end 15 of a next casing string 16 to the second end of a first pipe in the form of the bottom end 20 a preceding casing string 21.  
20 The bottom end 20 is provided with an anvil section 23.

The casing strings 16 and 21 are arranged in a borehole (not shown) drilled in the underground formation, and the preceding casing string 21 is secured to the formation by means of cement (not shown). In order  
25 that the next casing string can be lowered through the preceding one, its outer diameter is smaller than the inner diameter of the preceding casing string 21.

The device 10 comprises a cylindrical body 30 provided with an annular shoulder 32 for positioning the  
30 device 10 at the top end 15 of the next casing string 16. The device 10 is lowered into the preceding casing string 21 at the lower end of a drill string 31, of which the lower end is connected to the upper end of the cylindrical body 30.

The cylindrical body 30 is provided with an annular recess 34, in which annular recess 34 is arranged an explosive charge 37, which explosive charge 37 is covered by a protective sleeve 38. The cylindrical body 30 further comprises a device 40 for detonating the explosive charge 37. The device 40 for detonating the explosive charge is activated from surface by passing a signal through a cable 41 that extends to surface. The detonation is passed from the detonator 40 to the explosive charge 34 by transfer conduit 42.

During normal operation, the device 10 is brought into position as shown in the drawing, and the device 40 for detonating the explosive charge 37 is activated. The explosion of the explosive charge 37 causes the top end 15 of the next casing string 16 to deform. The anvil section 23 of the bottom end 20 of the preceding casing string 21 prevents further expansion of the top end 15. And thus the two casing strings are interconnected. After having made the connection the device 10 is pulled out of the well.

In order to improve the strength of the connection the anvil section 23 is provided with an annular recess 45.

In order to improve the sealing of the connection, a sleeve of shape-memory alloy (not shown) is provided on the outer surface of the first end of the second pipe and on the inner surface of anvil section, wherein the shape-memory alloy expands on heating to provide a metal-to-metal seal. Alternatively, the seal can also be a hard elastomeric part or a metal part.

The inner diameter of the anvil section can be so selected that the inner diameter of the second pipe (after expansion) is substantially equal to the inner diameter of the first pipe. Moreover, with known techniques the second pipe can be expanded over its full

C L A I M S

1. A device for connecting the first end of a second pipe to the second end of a first pipe, wherein the second end of the first pipe is provided with an anvil section, which device comprises a cylindrical body  
5 provided with an annular shoulder for positioning the device at the first end of the second pipe and an annular recess, an explosive charge that is arranged in the annular recess and a device for detonating the explosive charge.
- 10 2. Device according to claim 1, wherein the anvil section comprises an annular recess.
3. Device according to claim 1 or 2, wherein a sleeve of shape-memory alloy is provided on the outer surface of the first end of the second pipe and on the inner surface  
15 of the anvil section, wherein the shape-memory alloy expands on heating to provide a metal-to-metal seal.
4. Device according to claim 1 or 2, wherein a sleeve of a hard elastomer or a metal is provided on the inner surface of the anvil section.



A B S T R A C T

PIPE CONNECTING DEVICE

A device (10) for connecting the top end (15) of a second casing (16) to the bottom end (20) of a first casing (21), wherein the bottom end (20) of the first casing (21) is provided with an anvil section (23), which device (10) comprises a cylindrical body (30) provided with an annular shoulder (32) for positioning the device (10) at the top end (15) of the second casing (16) and an annular recess (34), an explosive charge (37) that is arranged in the annular recess (34) and a device (40) for detonating the explosive charge (37).

(Figure)

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